Rec'd PCT/PTO 04 MAR 2005
10/526958

FIG. 1

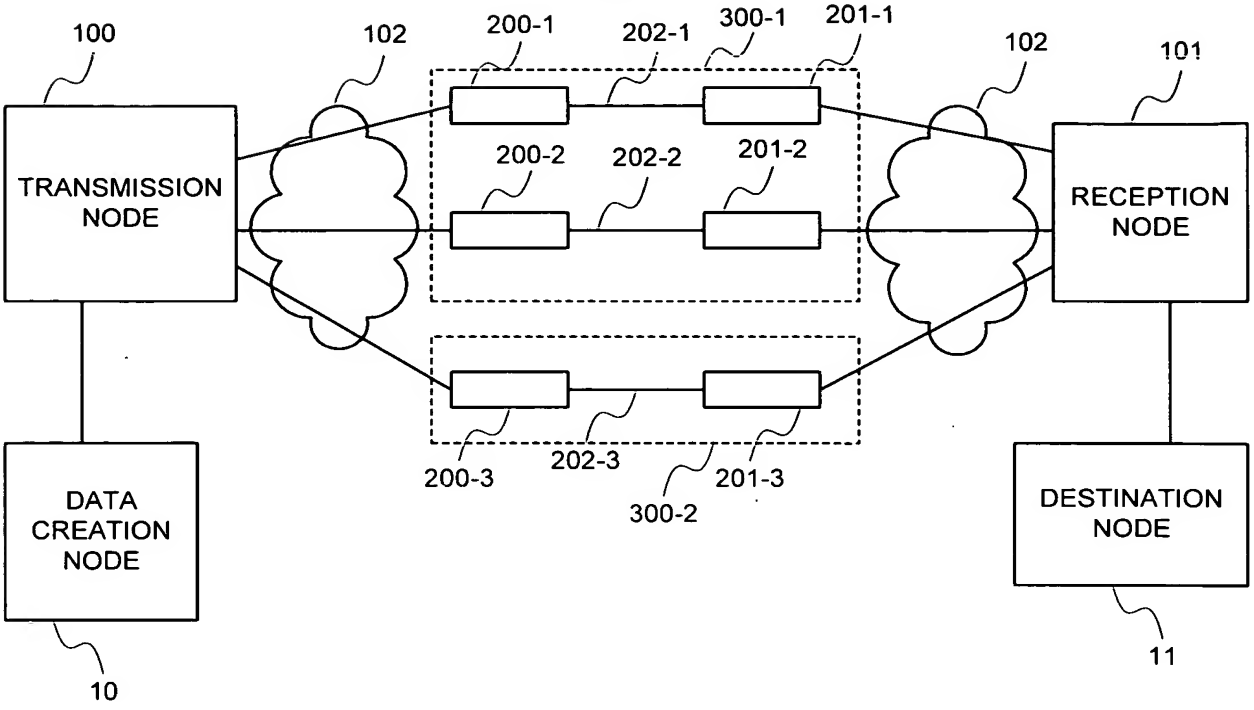


FIG. 2

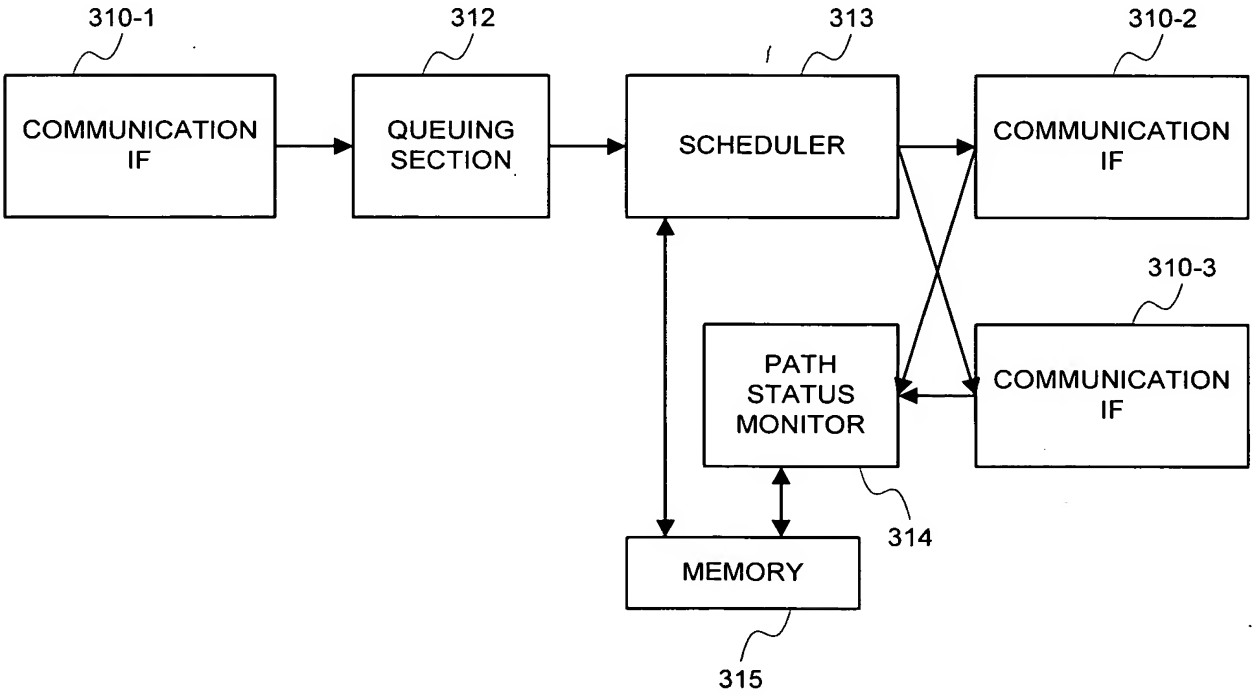


FIG. 3

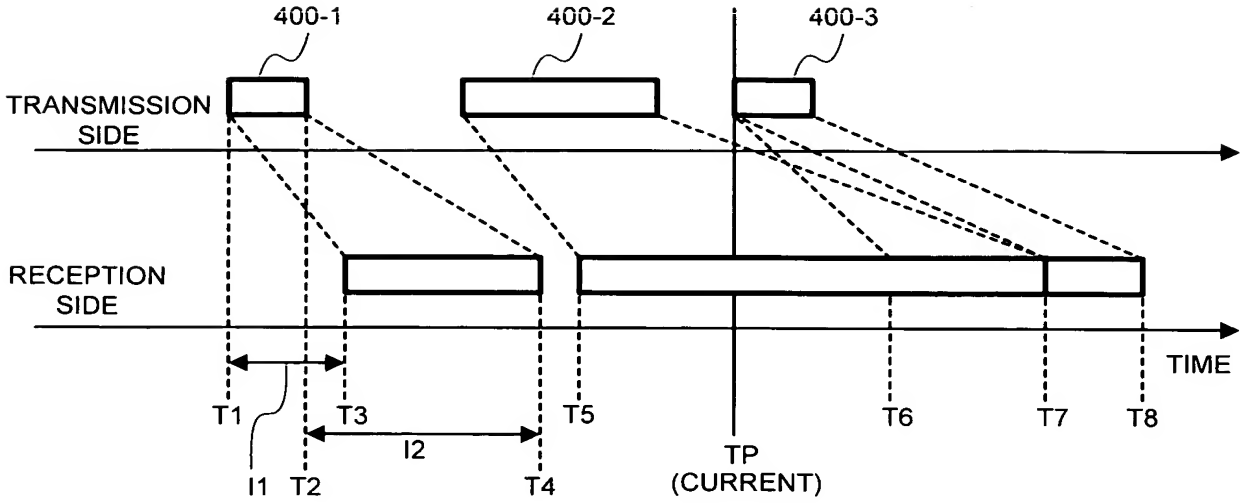

400-1
400-2
400-3
TRANSMISSION SIDE
RECEPTION SIDE
TIME
T1
T2
T3
T4
T5
T6
T7
T8
I1
I2
TP
(CURRENT)

FIG. 4

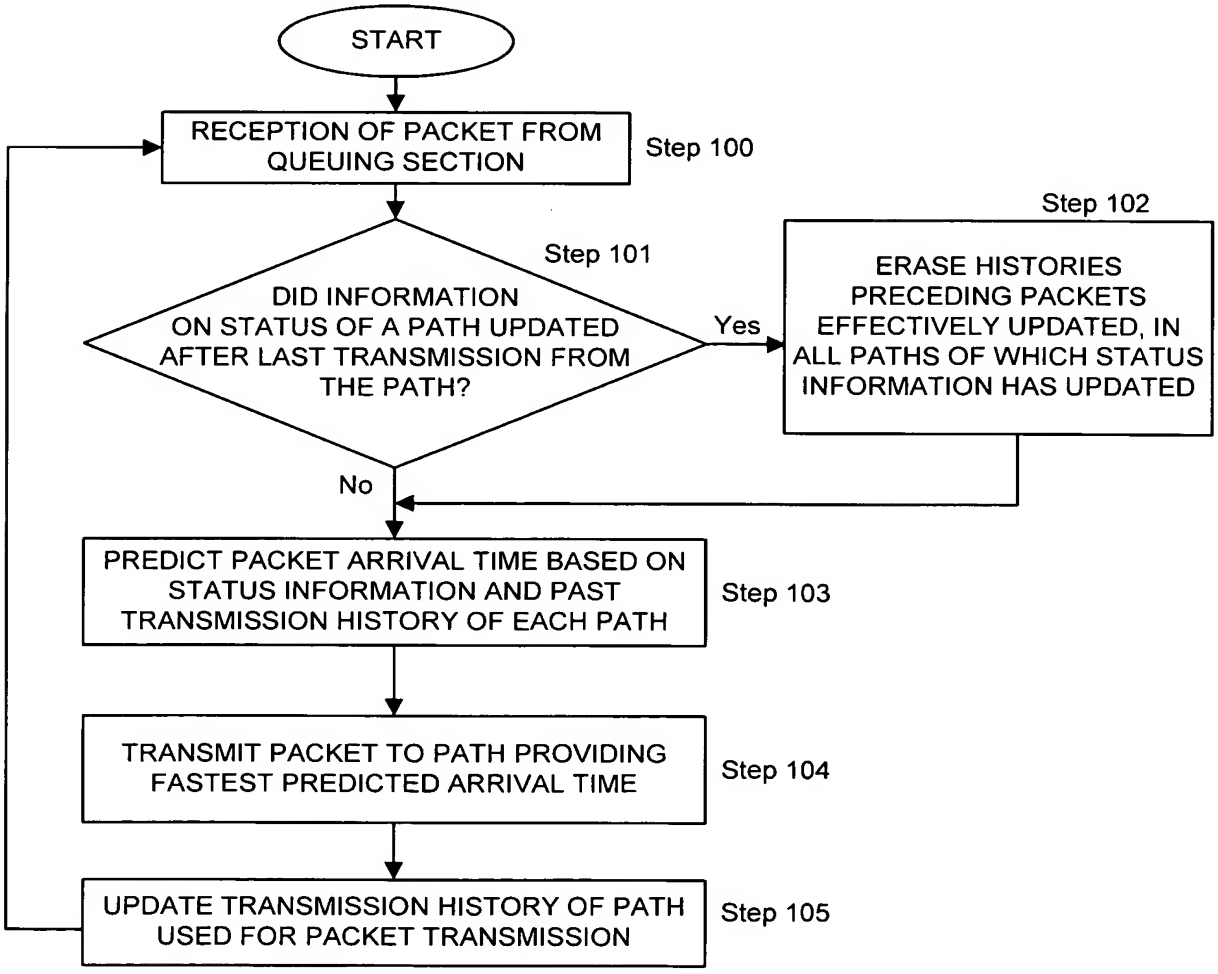

START
RECEPTION OF PACKET FROM QUEUING SECTION
Step 100
Step 101
DID INFORMATION ON STATUS OF A PATH UPDATED AFTER LAST TRANSMISSION FROM THE PATH?
Yes
Step 102
ERASE HISTORIES PRECEDING PACKETS EFFECTIVELY UPDATED, IN ALL PATHS OF WHICH STATUS INFORMATION HAS UPDATED
No
PREDICT PACKET ARRIVAL TIME BASED ON STATUS INFORMATION AND PAST TRANSMISSION HISTORY OF EACH PATH
Step 103
TRANSMIT PACKET TO PATH PROVIDING FASTEST PREDICTED ARRIVAL TIME
Step 104
UPDATE TRANSMISSION HISTORY OF PATH USED FOR PACKET TRANSMISSION
Step 105

FIG. 5

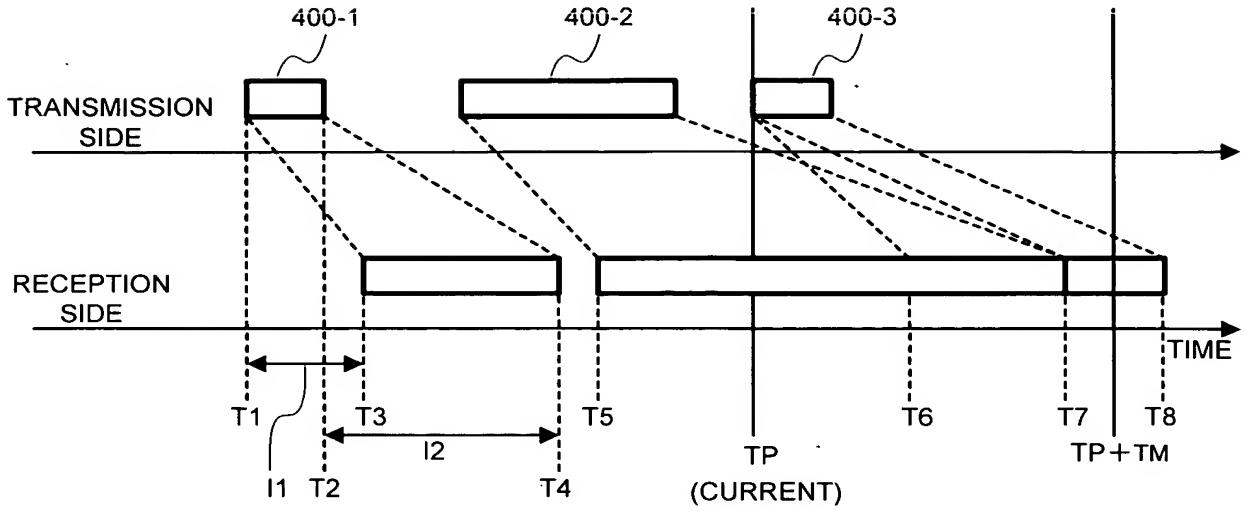

400-1
400-2
400-3
TRANSMISSION SIDE
RECEPTION SIDE
TIME
T1
T3
T5
T6
T7
T8
I2
I1
T2
T4
TP
(CURRENT)
TP+TM

FIG. 6

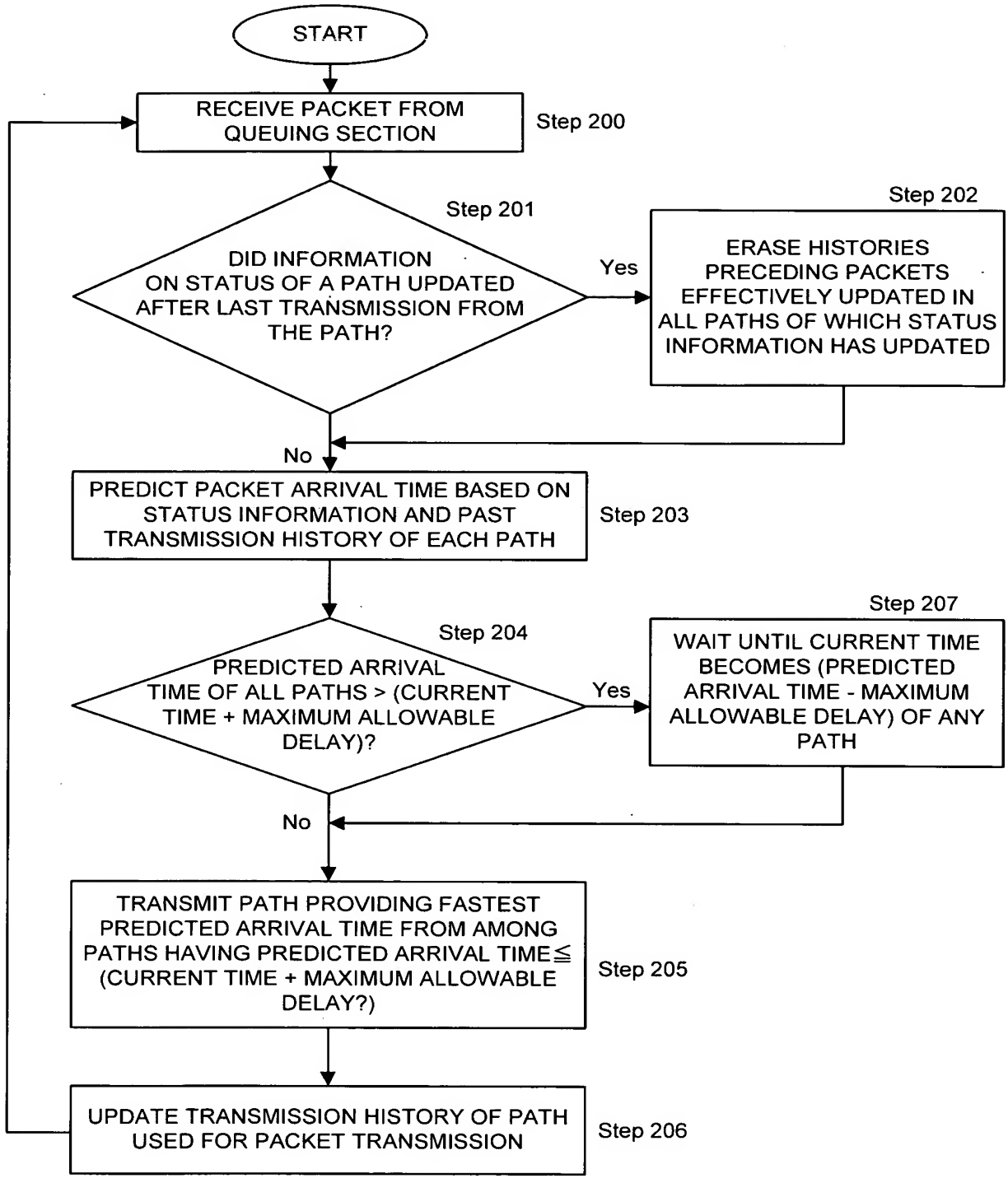

START
RECEIVE PACKET FROM QUEUING SECTION
Step 200
Step 201
DID INFORMATION ON STATUS OF A PATH UPDATED AFTER LAST TRANSMISSION FROM THE PATH?
Yes
Step 202
ERASE HISTORIES PRECEDING PACKETS EFFECTIVELY UPDATED IN ALL PATHS OF WHICH STATUS INFORMATION HAS UPDATED
No
PREDICT PACKET ARRIVAL TIME BASED ON STATUS INFORMATION AND PAST TRANSMISSION HISTORY OF EACH PATH
Step 203
Step 204
PREDICTED ARRIVAL TIME OF ALL PATHS > (CURRENT TIME + MAXIMUM ALLOWABLE DELAY)?
Yes
Step 207
WAIT UNTIL CURRENT TIME BECOMES (PREDICTED ARRIVAL TIME - MAXIMUM ALLOWABLE DELAY) OF ANY PATH
No
TRANSMIT PATH PROVIDING FASTEST PREDICTED ARRIVAL TIME FROM AMONG PATHS HAVING PREDICTED ARRIVAL TIME≦ (CURRENT TIME + MAXIMUM ALLOWABLE DELAY?)
Step 205
UPDATE TRANSMISSION HISTORY OF PATH USED FOR PACKET TRANSMISSION
Step 206

FIG. 7

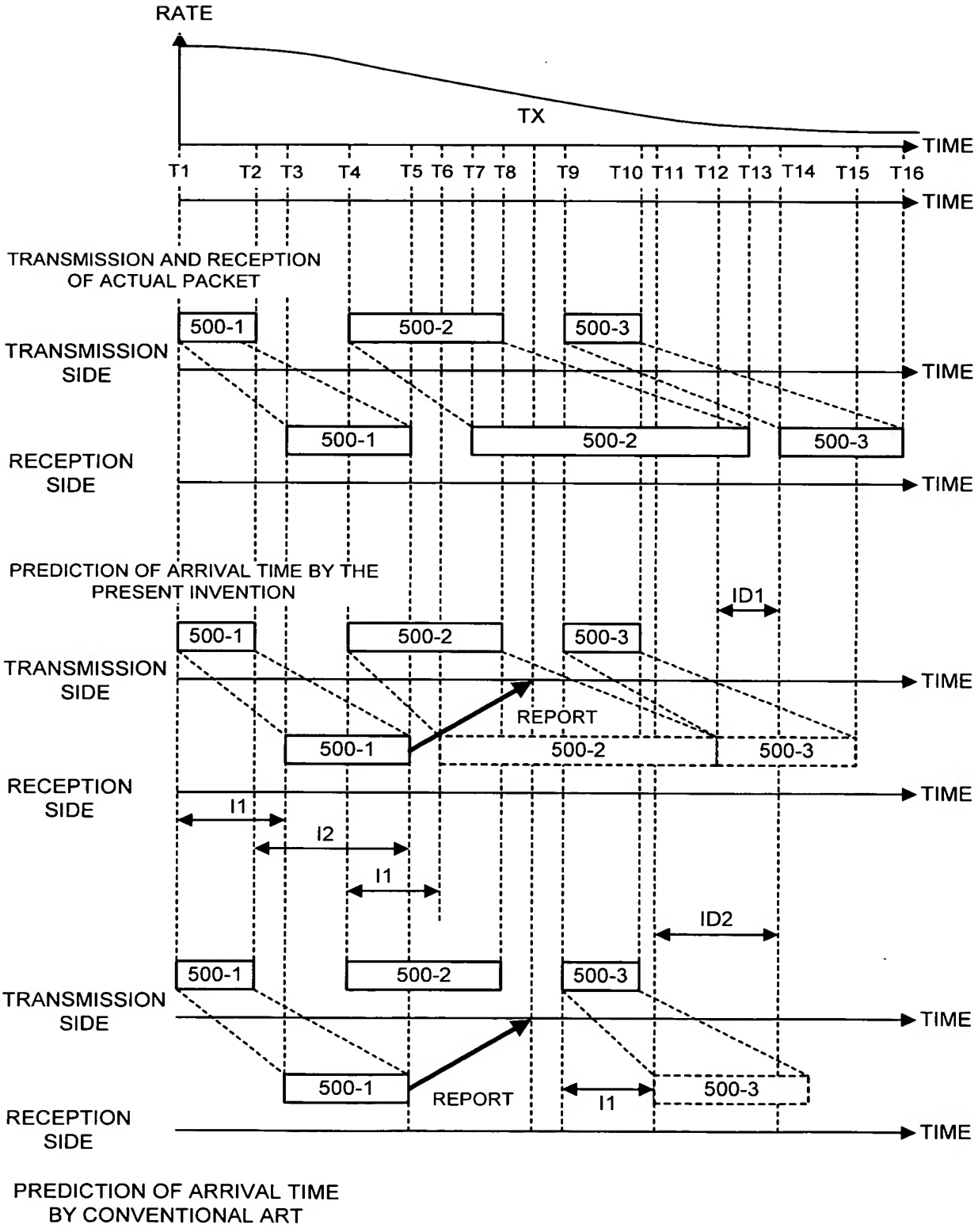
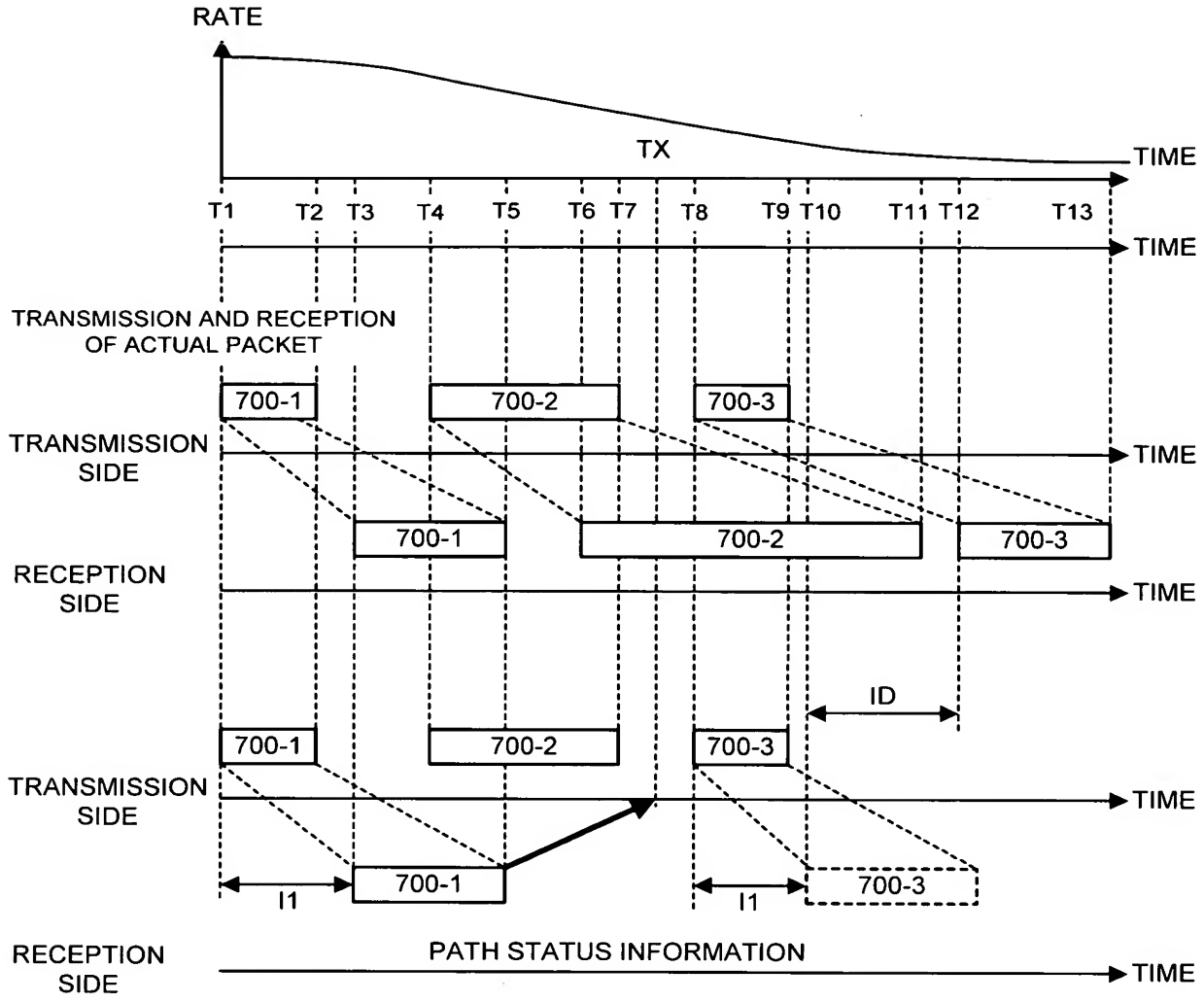

RATE
TX
TIME
T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12 T13 T14 T15 T16
TRANSMISSION AND RECEPTION OF ACTUAL PACKET
500-1
500-2
500-3
TRANSMISSION SIDE
RECEPTION SIDE
PREDICTION OF ARRIVAL TIME BY THE PRESENT INVENTION
ID1
REPORT
I1
I2
ID2
PREDICTION OF ARRIVAL TIME BY CONVENTIONAL ART

FIG. 8



PREDICTION OF ARRIVAL TIME IN CONVENTIONAL ART

FIG. 9

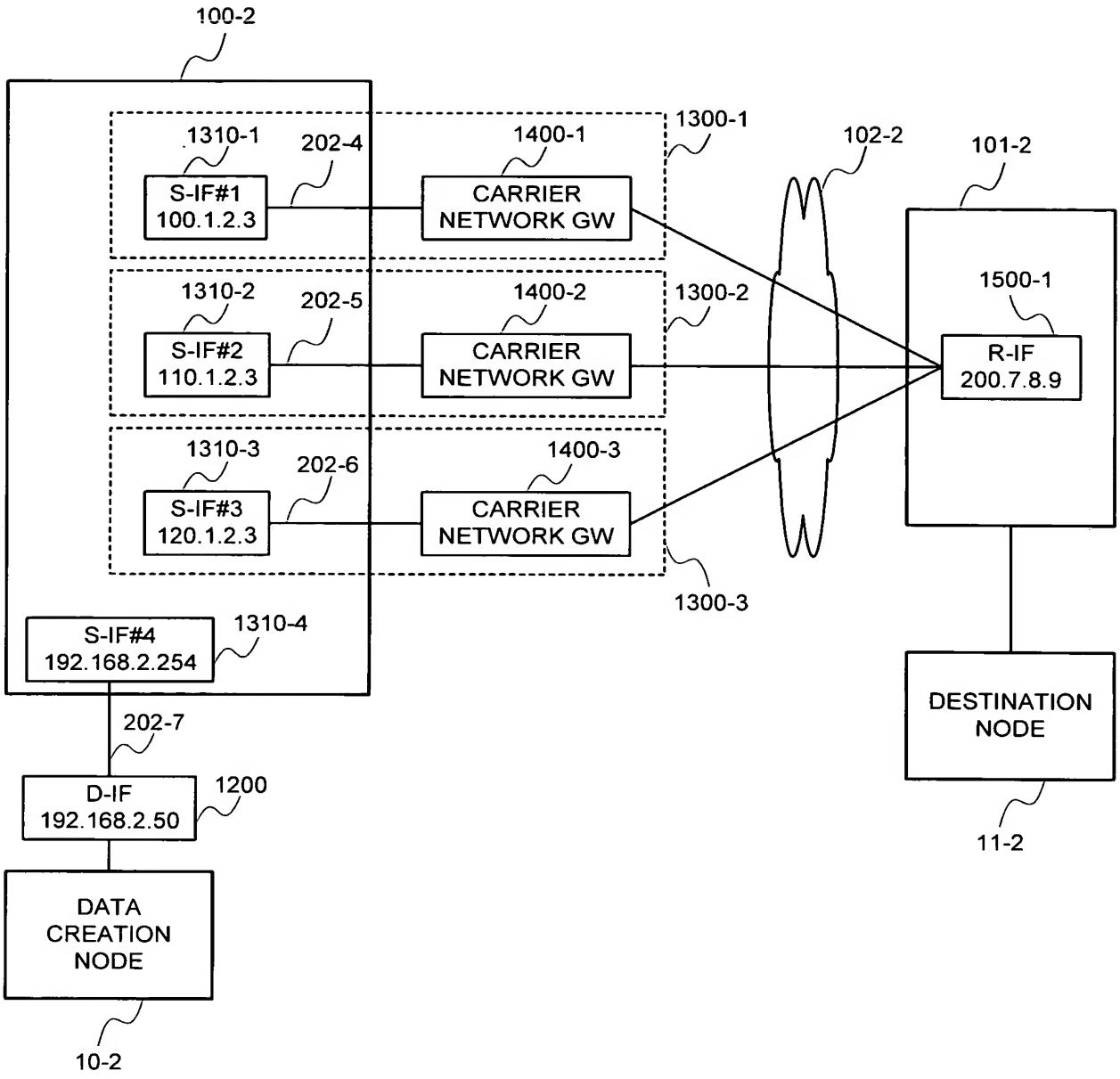

100-2
1310-1
202-4
1400-1
1300-1
S-IF#1
100.1.2.3
CARRIER
NETWORK GW
102-2
101-2
1310-2
202-5
1400-2
1300-2
1500-1
S-IF#2
110.1.2.3
CARRIER
NETWORK GW
R-IF
200.7.8.9
1310-3
202-6
1400-3
S-IF#3
120.1.2.3
CARRIER
NETWORK GW
1300-3
S-IF#4
192.168.2.254
1310-4
DESTINATION
NODE
202-7
D-IF
192.168.2.50
1200
DATA
CREATION
NODE
11-2
10-2

FIG. 10

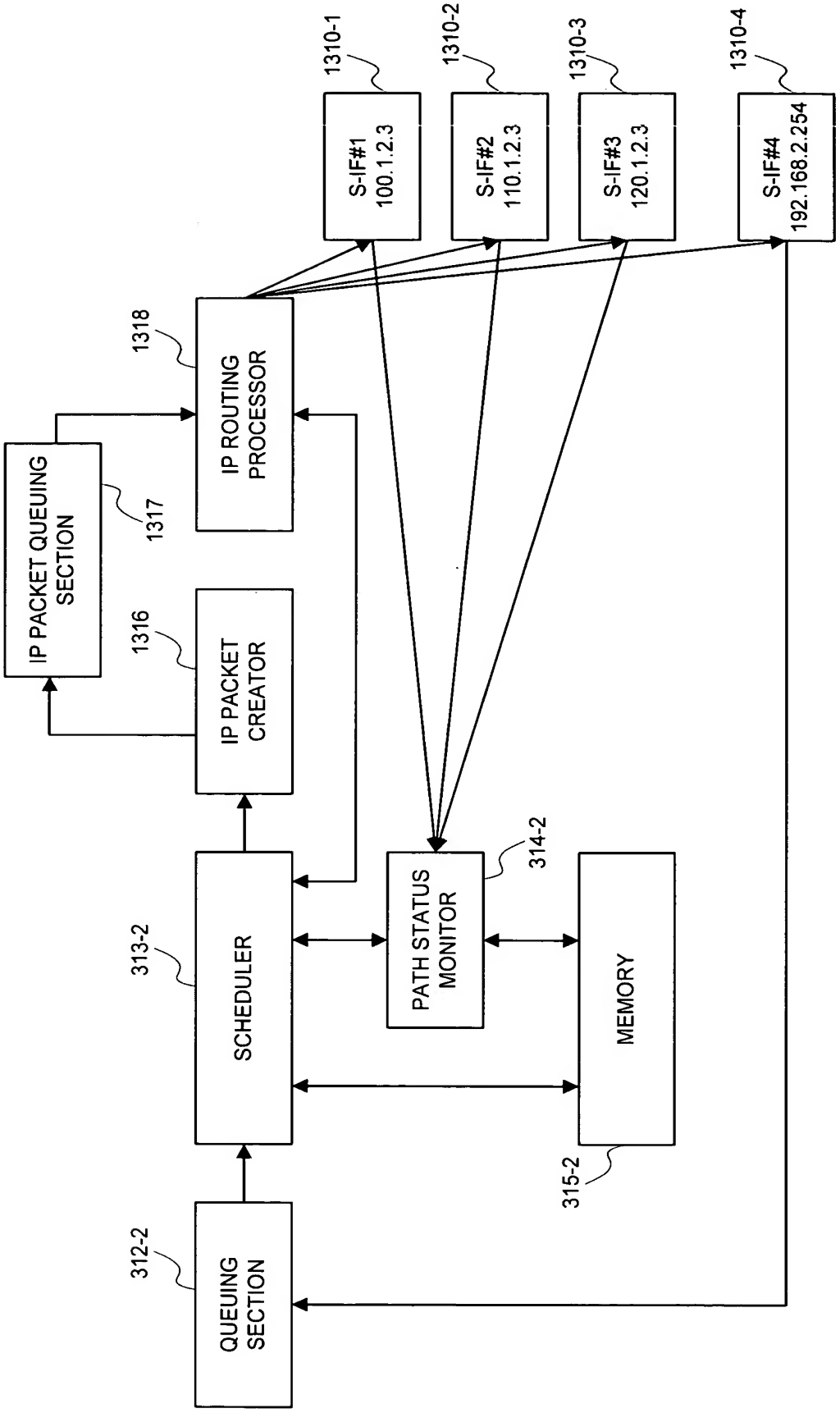

1310-1
S-IF#1
100.1.2.3
1310-2
S-IF#2
110.1.2.3
1310-3
S-IF#3
120.1.2.3
1310-4
S-IF#4
192.168.2.254
1318
IP ROUTING PROCESSOR
IP PACKET QUEUING SECTION
1317
1316
IP PACKET CREATOR
313-2
SCHEDULER
PATH STATUS MONITOR
314-2
MEMORY
315-2
312-2
QUEUING SECTION

FIG. 11

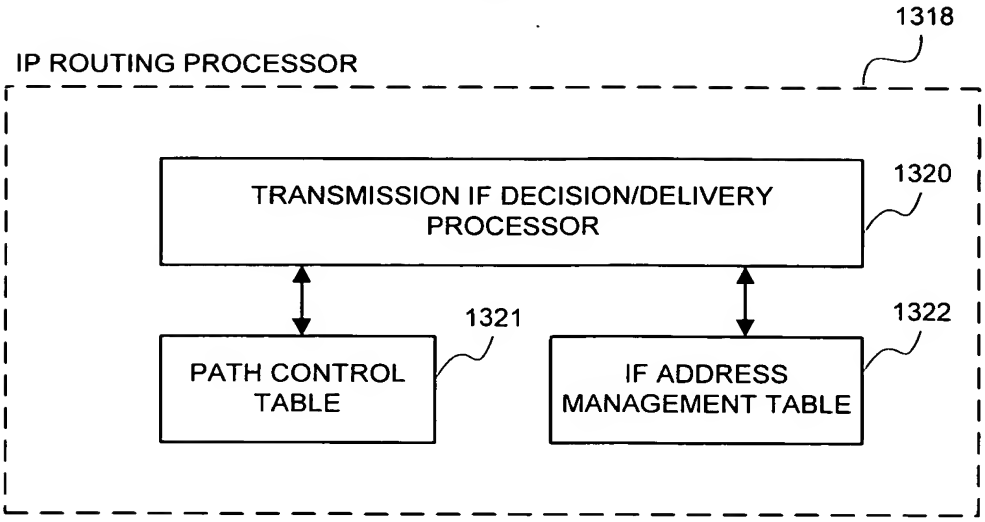


FIG. 12

PATH CONTROL TABLE

1321

DESTINATION NETWORK IP ADDRESS	NETWORK MASK	GATEWAY IP ADDRESS	COMMUNICATIONS INTERFACE	
200.7.8.9	255.255.255.255	100.1.2.4	S-IF#1	1321-a
200.7.8.9	255.255.255.255	110.1.2.5	S-IF#2	1321-b
200.7.8.9	255.255.255.255	120.1.2.4	S-IF#3	1321-c
192.168.3.50	255.255.255.0	192.168.3.49	S-IF#4	1321-d

FIG. 13

IF ADDRESS MANAGEMENT TABLE 1322

COMMUNICATIONS INTERFACE	ALLOCATION IP ADDRESS
S-IF#1	100.1.2.3
S-IF#2	110.1.2.3
S-IF#3	120.1.2.3
S-IF#4	192.168.3.254

FIG. 14

PATH TO COMMUNICATIONS INTERFACE CORRESPONDENCE TABLE 1330

COMMUNICATION PATH NUMBER	COMMUNICATIONS INTERFACE
1	S-IF#1
2	S-IF#3
3	S-IF#2

FIG. 15

TRANSMISSION IP PACKET CREATION DATA 1510

DESTINATION IP ADDRESS (200.7.8.9)	TRANSMISSION SOURCE IP ADDRESS (110.1.2.3)	TRANSMISSION DATA

FIG. 16

DELIVERY IP PACKET

IP HEADER			
TRANSMISSION SOURCE IP ADDRESS (110.1.2.3)	DESTINATION IP ADDRESS (200.7.8.9)	OTHER IP HEADER INFORMATION	TRANSMISSION DATA

1610

FIG. 17

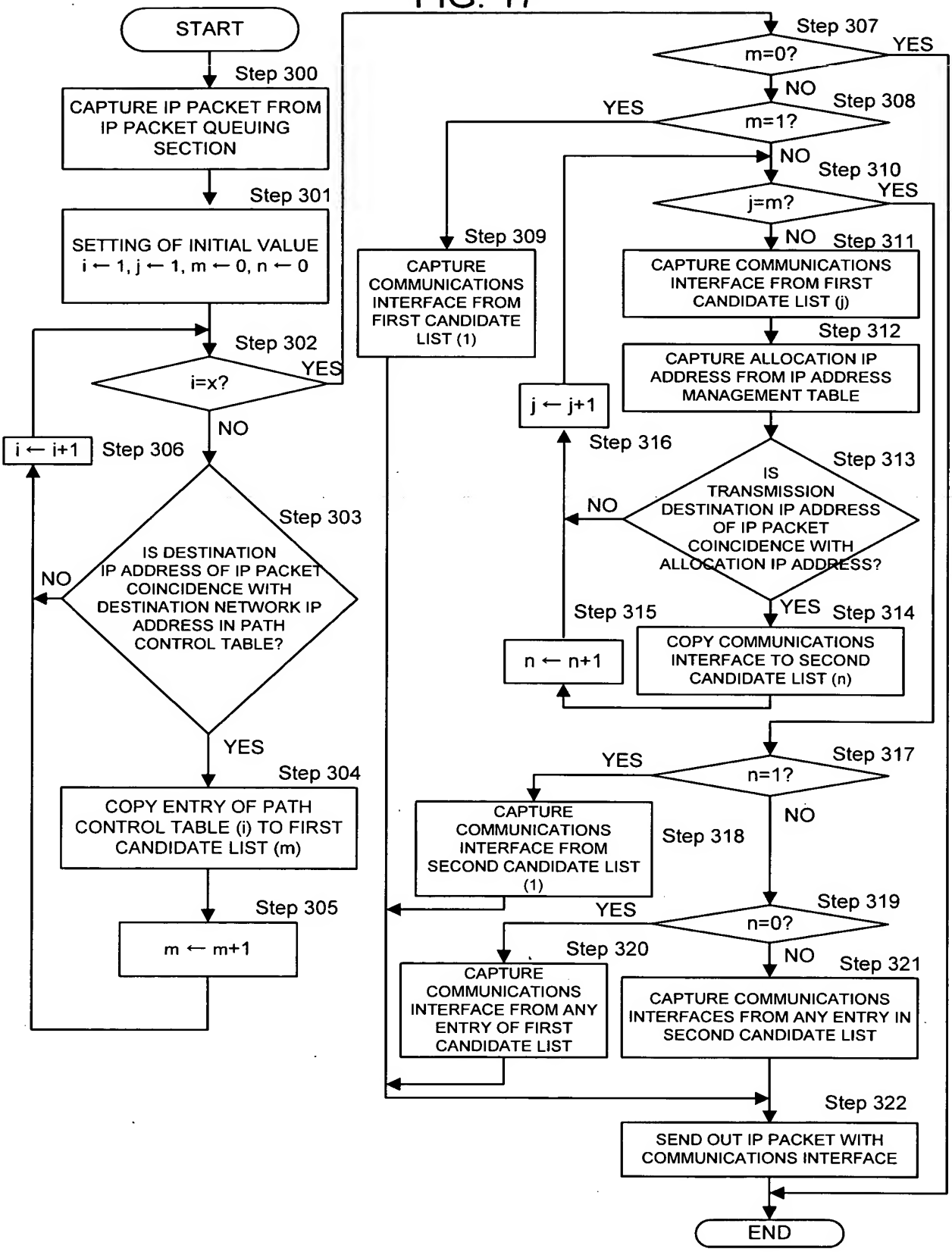

START
Step 300
CAPTURE IP PACKET FROM IP PACKET QUEUING SECTION
Step 301
SETTING OF INITIAL VALUE i ← 1, j ← 1, m ← 0, n ← 0
Step 302
i=x?
YES
NO
i ← i+1
Step 306
Step 303
IS DESTINATION IP ADDRESS OF IP PACKET COINCIDENCE WITH DESTINATION NETWORK IP ADDRESS IN PATH CONTROL TABLE?
NO
YES
Step 304
COPY ENTRY OF PATH CONTROL TABLE (i) TO FIRST CANDIDATE LIST (m)
Step 305
m ← m+1
Step 307
m=0?
YES
NO
Step 308
m=1?
YES
NO
Step 309
CAPTURE COMMUNICATIONS INTERFACE FROM FIRST CANDIDATE LIST (1)
Step 310
j=m?
YES
NO
Step 311
CAPTURE COMMUNICATIONS INTERFACE FROM FIRST CANDIDATE LIST (j)
Step 312
CAPTURE ALLOCATION IP ADDRESS FROM IP ADDRESS MANAGEMENT TABLE
Step 313
IS TRANSMISSION DESTINATION IP ADDRESS OF IP PACKET COINCIDENCE WITH ALLOCATION IP ADDRESS?
NO
YES
Step 314
COPY COMMUNICATIONS INTERFACE TO SECOND CANDIDATE LIST (n)
Step 315
n ← n+1
Step 316
j ← j+1
Step 317
n=1?
YES
NO
Step 318
CAPTURE COMMUNICATIONS INTERFACE FROM SECOND CANDIDATE LIST (1)
Step 319
n=0?
YES
NO
Step 320
CAPTURE COMMUNICATIONS INTERFACE FROM ANY ENTRY OF FIRST CANDIDATE LIST
Step 321
CAPTURE COMMUNICATIONS INTERFACES FROM ANY ENTRY IN SECOND CANDIDATE LIST
Step 322
SEND OUT IP PACKET WITH COMMUNICATIONS INTERFACE
END

FIG. 18

OTHER MODE OF TRANSMISSION IP PACKET CREATION DATA

1511

DESTINATION IP ADDRESS (200.7.8.9)	TRANSMISSION SOURCE INTERFACE ("S-IF#2")	TRANSMISSION DATA

FIG. 19

OTHER MODE OF DELIVERY IP PACKET

1611

IP HEADER			
TRANSMISSION SOURCE IP ADDRESS ("S-IF#2")	DESTINATION IP ADDRESS (200.7.8.9)	OTHER IP HEADER INFORMATION	TRANSMISSION DATA

FIG. 20

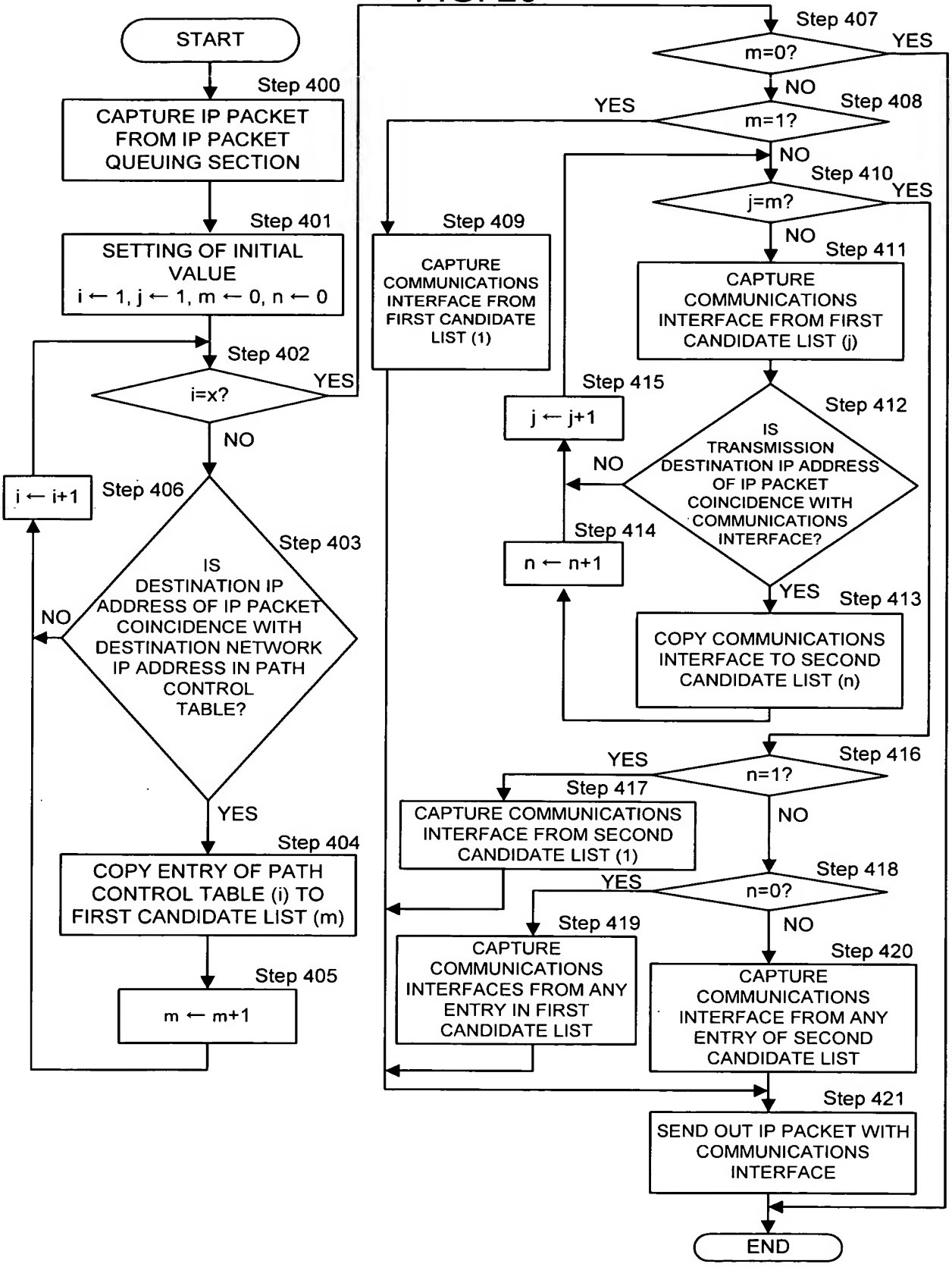

START
Step 400
CAPTURE IP PACKET FROM IP PACKET QUEUING SECTION
Step 401
SETTING OF INITIAL VALUE
i ← 1, j ← 1, m ← 0, n ← 0
Step 402
i=x?
YES
NO
i ← i+1
Step 406
Step 403
IS DESTINATION IP ADDRESS OF IP PACKET COINCIDENCE WITH DESTINATION NETWORK IP ADDRESS IN PATH CONTROL TABLE?
NO
YES
Step 404
COPY ENTRY OF PATH CONTROL TABLE (i) TO FIRST CANDIDATE LIST (m)
Step 405
m ← m+1
Step 407
m=0?
YES
NO
Step 408
m=1?
YES
NO
Step 409
CAPTURE COMMUNICATIONS INTERFACE FROM FIRST CANDIDATE LIST (1)
Step 410
j=m?
YES
NO
Step 411
CAPTURE COMMUNICATIONS INTERFACE FROM FIRST CANDIDATE LIST (j)
Step 412
IS TRANSMISSION DESTINATION IP ADDRESS OF IP PACKET COINCIDENCE WITH COMMUNICATIONS INTERFACE?
NO
YES
Step 413
COPY COMMUNICATIONS INTERFACE TO SECOND CANDIDATE LIST (n)
Step 414
n ← n+1
Step 415
j ← j+1
Step 416
n=1?
YES
NO
Step 417
CAPTURE COMMUNICATIONS INTERFACE FROM SECOND CANDIDATE LIST (1)
Step 418
n=0?
YES
NO
Step 419
CAPTURE COMMUNICATIONS INTERFACES FROM ANY ENTRY IN FIRST CANDIDATE LIST
Step 420
CAPTURE COMMUNICATIONS INTERFACE FROM ANY ENTRY OF SECOND CANDIDATE LIST
Step 421
SEND OUT IP PACKET WITH COMMUNICATIONS INTERFACE
END

FIG. 21

PATH CONTROL TABLE

1321

DESTINATION NETWORK IP ADDRESS	NETWORK MASK	GATEWAY IP ADDRESS	COMMUNICATIONS INTERFACE
200.7.8.9	255.255.255.255	100.1.2.4	S-IF#1
200.7.8.9	255.255.255.255	110.1.2.5	S-IF#2
200.7.8.9	255.255.255.255	120.1.2.4	S-IF#3

1321-a

1321-b

1321-c